

Appl. No. : 10/759,953  
Filed : January 16, 2004

### REMARKS

Claims 1-3, 5, 6, 8-19, and 45 are currently pending. Claims 11-13 have been withdrawn from consideration. Claims 4, 7, and 20-44 are cancelled. Claim 1 has been amended. No new matter has been added by this amendment. The amendment does not broaden the scope of the claim in a manner that would require an additional art search, as previously presented Claim 9 did not recite the characteristic of the internal surface of the piping.

#### *The Recited Valve Results in a Novel and Nonobvious Combination*

The Examiner has rejected Claims 1-3, 5, 6, 8-10, and 14-16 under §103(a) as being unpatentable over Shang et al. EP 0697467, in view of Igarashi et al. ('571), Iyer et al. ('109), and Yin et al. ('812) or Fong et al. ('403), or Fong et al. ('831), or Sun et al., ('183), or Fukuda et al. ('578). These references also form the basis of the rejection of Claims 17-19 and 45.

Independent Claim 1 recites, among other elements, "a valve positioned in the piping, wherein the valve has an opening that, when fully open, defines a pressure drop across the valve of less than about 0.25 Torr." Independent Claim 9 recites, among other elements, "a valve positioned in the piping, wherein an opening of the valve is sized, when fully opened, substantially equal in width to an inner surface of the piping, and the valve does not have projections, when fully opened, with respect to the inner surface of the piping." Thus, each of the pending claims recite either a particular low pressure drop across the valve when open, or a valve with no internal projections when open. As noted in the specification, these are generally described as "through-flow" valves (see original claims 5, 7-9, and paragraphs 0117, 0021 and 0023 of the application as published). As will be appreciated by one of skill in the art, there are a variety of valves and not all valves necessarily have the recited characteristics.

The Examiner has asserted that the above particular type of valve with the recited characteristics is taught by one or more of the following references '812, '403, '831, '183, and/or '578, in the claimed context. The Examiner has asserted that the remaining elements of Claim 1 and/or 9 are taught by various pieces of the cited art. Applicants respectfully disagree.

None of the cited references either teaches or suggests the use of valves that either have the recited pressure drop (Claim 1) or the lack of internal projections (Claim 9) in the claimed context. Furthermore, as noted below, there are many references, such as Shang et al. (U.S. Pat.

No. 5,788,778), that positively teach that a flow restrictor, *e.g.*, a needle valve, is to be used when a remote plasma cleaning chamber and a CVD chamber (*i.e.*, exactly at the recited location) is used.<sup>1</sup> Of course the positive teaching of such a “restrictor” teaches away from the recited valve limitations, which of course would minimize restrictions.

As explained below and in the specification, the recited valve has particular properties that are especially advantageous when used in the present combination. Moreover, the cited references, as well as the Examiner’s proposed motivation (regulation of the rate of introduction of activated gas into the treating chamber), would not motivate one of skill in the art to use the presently recited valve. *See*, *Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720, 724, 16 USPQ2d 1923, 1927 (Fed. Cir. 1990) (noting the relevance of when the closest prior art reference “would likely *discourage* the art worker from attempting the substitution suggested”).

Indeed, in the present situation, the closest of the references actually teaches away from the presently recited valve. Thus, even assuming a *prima facie* case of obviousness could be established through the Examiner’s above assertions, it would be rebutted because several references actually taught away from using the presently recited type of valve as claimed. In fact, the Examiner’s asserted motivation of regulating flow teaches away from the recited type of valve, since a variable flow valve implies restrictions in flow during use. Note that the Examiner must consider teachings away (*In re Dow Chemical* 5 USPQ.2d 1529, 1531-32 (Fed. Cir. 1988)) and the Examiner provides no teachings or reference to counter these teachings away. Rather, the Examiner merely attempts to dismiss the issue as “moot.”

In the interest of assisting the examination, Applicants note that some of these issues have been examined previously by the Patent Office. The Patent Office previously found that the use of the recited types of valves between the recited remote plasma cleaning source and a CVD reaction chamber is patentable. In particular, in the Office Action mailed on October 22, 2003, in the parent application, (now U.S. Pat. No. 6,736,147) the Examiner noted that “the prior art of record does not appear to appreciate that the etch rate may be improved reducing the collisions between the species source and the product by changing the valve type.” (page 6, emphasis added). Applicants note that the present claims recite related features of this type of valve (*e.g.*,

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<sup>1</sup> “Flow restrictor 59 may be, for example, a small orifice or a series of small orifices, although any device that creates a pressure differential, such as a reduction valve or a needle

low pressure drop, lack of internal projections) at the same location between the recited remote plasma cleaning chamber and a CVD chamber. Moreover, the references cited by the Examiner in the present rejection do not alter the above statement because the references do not address the pressure drop characteristics or internal structural characteristics of the valves. This is explained in more detail below.

*The Claimed Valve is Not Taught by the Cited Art for this Use*

Claim 1 recites that the valve has an opening that, when fully open, defines a pressure drop across the valve of less than about 0.25 Torr. Claim 9 recites a valve that does not have projections, when fully opened, with respect to the inner surface of the piping. Indeed, with the apparent exception of Shang (U.S. Pat. No. 5,788,778) the cited references are largely silent with respect to any particular aspects of the valves in the recited location. Moreover, none of the references disclose the actual interior arrangement of the valve (such as that shown in Figure 4A and 4B of the present application). The references only teach that the generic idea that a valve could be included in various devices. Some references do teach a valve that is capable of acting as a flow restrictor, which, as noted above, teaches away from the claimed invention; however, this appears to be the extent of the discussion of the valves. As such, none of the cited references describe or illustrate the presently recited valve features (in either Claim 1 or Claim 9) in the relevant context. We now address each of the cited references individually.

Yin's valve 225 is not disclosed as having such features (low pressure drop or lack of internal projections), in either the figures or the description of the Figures (see page 16 and Figure 4).

The internal structure of Fong's valve 280 in the '403 and the '831 references is not illustrated and no details are provided in either the figure or its description (see col. 26, lines 15-59 and Figure 1A).

Sun's valve 62 is not disclosed as having such features (low pressure drop or lack of internal projections), in either the figure or its description (see 0013 and Figure 1). Indeed, Sun actually teaches that the valve is a "flow restrictor" which is used to maintain a minimal pressure differential between the remote plasma chamber and the deposition chamber. Thus, if anything,

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valve, could be employed." (Col. 5, lines 26-31)

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Sun teaches away from a valve that has the recited features (low pressure drop or lack of internal projections).

Fukuda's valve 15 is not disclosed as having such features (low pressure drop or lack of internal projections) in either the figures or its description (see 0073, 0074, 0083, and Figures 1 and 2).

Given that the cited references are silent in regard to the above properties for the valve in the claimed context, the cited references fail to teach each and every feature of the claims in the claimed combination.

Applicants note that there is a wide variety of possible valves that could be used in the claimed device, as well as to separate the remote cleaning chamber from the reaction chamber in particular. For example, Shang et al. (U.S. Pat. No. 5,788,778) positively teaches the use of a needle valve at the recited location as a "flow restrictor." Fukuda describes a couple of possible valves (a gate valve, a controlling valve). Fong et al. describes a number of valves in their device as well (a gate valve, a throttle valve, a shut-off valve, a switching valve, a slit valve, an isolation valve, a control valve, and a particle grade gate valve). It is clear that there are a number of valves that can be used in such devices. However, none of the cited references teach that their variously identified valves necessarily possess the presently claimed characteristics, to say nothing of their usefulness between a remote plasma chamber and a CVD chamber.

Because none of the cited references teach the aspects of the valve that are recited in the present claims (Claims 1 or 9), a *prima facie* case of obviousness has not been established. Applicants respectfully request that the rejections be withdrawn and the claims allowed. All other claims depend from Claims 1 or 9 and are therefore non-obvious as well.

*No Motivation or reason has been supplied for selecting valves with the presently recited features.*

As noted above, there are a wide variety of valves that one of skill in the art could have used in the claimed combination. However, the Examiner has not provided any motivation for why one of skill in the art would have selected valves with the presently recited features (low pressure drop or lack of internal projections when open) in the presently claimed combination. Rather, the Examiner states only that they would have been motivated to use a valve "in order to

regulate the rate of introduction of activated gas into the treating chamber” which goal could be accomplished by any number of valves that would not meet Applicants’ claims. As described below, not all valves are considered the same, the presently recited valve features have particular advantages, and the art actually taught basic principles that taught away from the use of the presently recited valves. As no motivation has been supplied as to why the particularly recited valve features would have been used in the claimed combination, a *prima facie* case of obviousness has not been established.

*The Claimed Valve has a Particular Advantage When Used in the Claimed Combination*

As noted previously, the use of valves with the recited features in the claimed context is not an arbitrary adjustment to the device. Rather, the use of the recited valves allows one to increase the performance of the device. For example, some of the advantages are as follows:

deactivation (recombination) of fluorine active species is reduced, due to reduced collisions with the piping surface and structure within the valve. Accordingly, applying radio frequency power of less than 3,000 W to the remote plasma discharge chamber, high-speed cleaning at over 2 micron/min becomes possible. Furthermore, reduced collisions also minimizes thermal energy generated when fluorine active species is deactivated, thus reducing overheating of the piping and the valve. Heat damage to O-rings and other components, and consequent generation of particles is also reduced or eliminated. The frequency with which damaged parts are replaced thus decreases, and operating costs of the device can be decreased while at the same time increasing productivity of the device. ([0026] of the specification).

Simply put, the use of the recited valve (e.g., that in Claim 1 or 9), in combination with the other claimed elements allows for lower amounts of power to be used in the remote plasma discharge chamber while allowing for high-speed cleaning to become possible. This clearly results in a superior device. Thus, the element of the particular type of valve must be given appropriate consideration in determining patentability of the device. Not only does the art fail to recognize such efficiency as an issue for plasma cleaning of a CVD chamber, but as discussed in the following section, the most relevant art previously taught away from the use of these valves or the primary characteristic of these valves.

*The Prior Art Taught Away from the Use of a Through-Flow Valve in Cleaning.*

As noted in the previous Response, the art of record taught to restrict the flow, such as with filters or through the choice of valve itself. The fact that this was the current understanding in the art at the time of the invention is also noted in the present application (*see, e.g.*, 0009-0011 and 0042 of the present Application). Applicants respectfully remind the Examiner that statements in the specification must be accepted by the Examiner, absent some evidence to the contrary. Applicants note that none of the cited art contradicts this statement nor the teachings away in general. Indeed, as detailed below, most of the references explicitly agree with this statement.

U.S. Pat. No. 5,788,778 ("Shang, '778"), teaches the use of a "flow restrictor" to prevent the free flow of gas between a remote chamber and the deposition chamber (*see, e.g.*, "A flow restrictor 59 is employed in pipe 57. Flow restrictor 59 may be placed anywhere in the path between remote chamber 46 and deposition chamber 10." (col. 4, lines 48-50). Indeed, the type of valve disclosed in Shang, a "needle valve," is explicitly disclosed as useful because it creates a significant pressure differential. (col. 5, lines 22-30). Thus, Shang '778 clearly teaches that the valve to be used should be selected based on its ability to create a pressure differential, while the presently recited valve features (low pressure drop or no internal projections when open) accomplish just the opposite, minimizing any pressure differential created when fully opened.

Additionally, many references teach aspects that further slow down the flow of gas, thereby making the use of the recited valve pointless or counter intuitive. For example, a "flow restrictor," which slows down the flow is specifically taught in U.S. Pat. No. 6,274,058. Additionally, Sun et al., presently cited in the current Office Action, teaches the use of a "flow restrictor" (0013). Additionally, Shang EP 0697467 teaches that a filter 56 should be placed between the remote chamber 46 and the processing chamber. Applicants note that the use of filters in this location was common and that their use will result in the restriction of the flow of gas, making the presently recited type of valve a pointless modification.

Moreover, even Fujimura, (a previously asserted reference), teaches away from the use of the presently recited valves. Applicants note that Fujimura teaches projections 22 with respect to the inner surface of the piping. Furthermore, the identified "valve" of Fujimura employs a gas diffusing plate 25 which is "fixed in front of the activated gas" (FIGS. 3-5 and col. 3, lines 44-

54). As such, it is clear that Fujimura's "valve" cannot be positioned such that it allows an unobstructed flow of cleaning gas. Thus, the skilled artisan will appreciate Fujimura's valve will naturally cause a significant pressure drop even when fully open. Applicants note that the resultant obstruction of the gas flow was intentional and desired by Fujimura. Fujimura states that "[t]he gas diffusing means... constitutes the most important feature of the present invention...." The gas diffusing means can comprise the diffusing plate 25 (emphasis added, col. 3, lines 42-44). Clearly, Fujimura teaches that the gas should be obstructed by the plate. Applicants note that the use of a diffusing plate teaches away from a desire for low pressure drop. That is, the presently recited valve features have the opposite effect of a diffusing plate in that they do not restrict the flow of the gas. (*See, e.g.*, 0026).

Thus, it is clear that, at the time of filing of the application, one of skill in the art would not have used valves with the recited features in the recited apparatus because the art was focused on slowing, restricting, and controlling the flow, rather than using a device that minimized pressure differences on either side of the valve. Indeed, the benefits of the recited valves are opposite in nature to a diffusing plate valve or flow restricting valves or filters. The Examiner is respectfully reminded that "a *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." *In re Geisler*, 116 F.3d 1465, 1471, 43 U.S.P.Q.2d 1362, 1366 (Fed. Cir. 1997)" (M.P.E.P. §2144.05 III). As the art clearly taught that items that obstructed/restricted the flow of gas were desirable, the art taught away from a valve that "when fully open, defines a pressure drop across the valve of less than about 0.25 Torr" (Claim 1) or a valve that "is sized, when fully opened, substantially equal in width to an inner surface of the piping, and the valve does not have projections, when fully opened, with respect to the inner surface of the piping" (Claim 9).

Applicants note that the above arguments were previously presented, but not addressed in the last Office Action (and were considered "moot.") Applicants request that the claims and the present remarks be fully considered and any subsequent Office Action adequately address the present remarks. The Examiner is respectfully reminded that disclosures that teach away from the claimed invention must be considered. ("A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983),

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*cert. denied*, 469 U.S. 851 (1984)" M.P.E.P. §2141.02VI, *see also*, In re Dow Chemical, 5 USPQ.2d 1529, 1531-32 (Fed. Cir. 1988)).

Because the cited references do not disclose the claimed elements in the relevant context, a *prima facie* case of obviousness has not been established. Similarly, the Examiner has not supplied a motivation for why one of skill in the art would have selected the presently recited valves over those taught in the art. Moreover, even if a *prima facie* case of obviousness had been established, it would have been rebutted by the fact that the above cited references actually teach away from the proposed combination.

Applicants request that the rejection be withdrawn and the claims allowed. The dependent claims depend from either Claim 1 or Claim 9 and are therefore non-obvious for the reasons noted above, as well as for their additional elements.

#### CONCLUSION

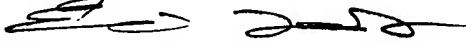
In view of the foregoing amendments and remarks, Applicants respectfully submit that the pending claims are in condition for allowance and request the same. If, however, some issue remains that the Examiner feels can be addressed by Examiner Amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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By: 

Eli A. Loots  
Registration No. 54,715  
Attorney of Record  
Customer No. 20,995  
(415) 954-4114

2805623  
081506